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# C-X CARGO COMPARTMENT CONSIDERATIONS

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C-X CARGO COMPARTMENT CONSIDERATIONS (U)

1. The optimum cargo compartment of an airlift aircraft is driven by two factors, (1) the frequency distribution of different vehicle sizes to be carried and, (2) the weight of those vehicles. Outsize vehicles, which tend to be larger and heavier, are more dense, while oversize vehicles which are smaller and lighter, are less dense. It is difficult to optimize the design of one airplane to carry both oversize and outsize cargo efficiently, as measured by the percent of floor area and allowable cabin load (ACL) utilized by its various payloads. Cargo compartment density ratio can be expressed as the maximum ACL divided by the available floor space. An airplane which efficiently carries outsize cargo will have a higher density ratio than one that is oversize efficient.
2. The optimum cargo compartment for the C-X is sensitive to the airlift requirements established in the C-X Request for Proposal (RFP). These requirements are a representative distillation of the forces deployed in the five scenarios examined by the C-X Task Force. These scenario forces were picked from a "shopping list" of available units which is in concert with OSD, JCS, and the RDF-JTF. They were tailored for the specific threat within each scenario by Army, Marine Corps, and Air Force representatives assigned to the Task Force. The RFP forces selected are comprised of a typical blend of outsize and oversize cargo from the light and heavy combat and combat support units deployed in the five scenarios. Thus, they should provide an excellent data base for aircraft cargo compartment sizing.
3. The airlift requirement could drive the C-X solution in two basic ways. If the requirement is predominantly outsize the cost effective cargo compartment would have a higher density ratio. A floor width of 156 inches would be the minimum to carry one row of outsize vehicles. A floor length of about 1000 inches and an ACL of about 136,000 pounds would be optimum for this width, similar to the AMST. This airplane would achieve a high weight utilization (90-95%) and a relatively high space utilization (60-70%) for outsize cargo. However its smaller floor space would do poorly carrying pallets and oversize vehicles because it is not wide enough to accommodate two rows of either. This causes wasted space in width and low weight utilization because oversize or palletized cargo is less dense than outsize cargo.
4. If the airlift requirement is predominantly oversize and bulk, the more effective airplane would either have a width to accommodate one row of vehicles and pallets (C-141 or C-130 width of 123 inches) or a width to allow double rows of pallets and oversize vehicles (188 to 228 inches). The ACL would be engineered to match the normal density of oversize and pallet loads. Examples are a C-141B with a 90,000 lb ACL and a 228 inch wide C-5 carrying two rows of oversize or pallets with a 240,000 lb ACL.

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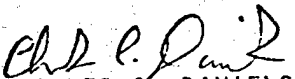
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5. The RFP requirement is about 40% outsize, midpoint between the extremes of all outsize or all oversize. This indicates that the airplane should at least be outsize capable (width 156 inches), ruling out the single row capable oversize airplane (C-141 type). However, the minimum outsize carrier (156 inch width) does not carry two rows of oversize vehicles or pallets and therefore is not very efficient in the non-outsize role. To achieve better efficiency, width must be increased to at least 188 inches for sideways double pallet loading and could go to 228 inches (C-5) for conventional double pallet loading. Some double row combinations of vehicles can be achieved at 188 inch width but more are possible at 210 inch width. As the width grows to 228 inches (C-5) even more combinations are possible, however, as the floor area increases, the space utilization efficiency of carrying outsize decreases. (A C-5 uses 29% of its floor area when carrying two tanks.)

6. The overriding factor when considering any of these options is cost. AF/SA has found some significant advantages in certain boxsizes when loading the RFP forces. Indications are that a width of 188 inches does very well but that a width of 210 inches may be even better. However, because the cost data will not be available until the contractors respond to the RFP it is difficult to now identify a best cost effective solution. The Air Force need not advocate a preferred aircraft solution until the RFP responses are received.

  
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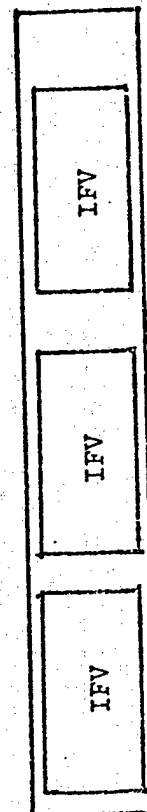
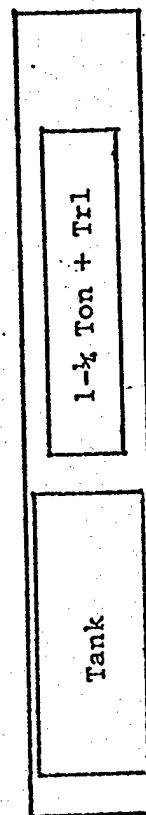
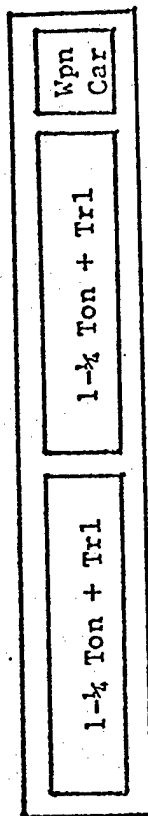
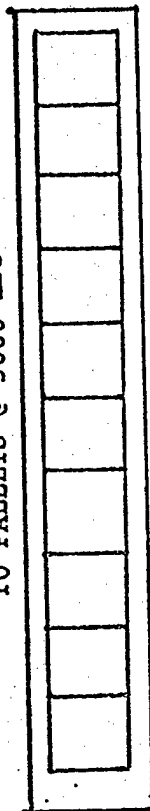
### OBSERVATIONS

1. All load descriptions shown are nominal representative examples, not necessarily picked to indicate best or worst case conditions. One bulk pallet loading, one oversize, and two outsize examples are shown.
2. The three airplane sizes considered range from AMST size to C-5 size, particular boxsize dimensions are shown on each graph.
3. Density ratio is the allowable cabin load (ACL) divided by the floor area (length x width).
4. All airplanes achieve 100% weight utilization when carrying outsize cargo.
5. The small high density ratio airplane achieves higher space utilization than do the larger ones when carrying outsize (63% vs 47% vs 26%).
6. The larger airplanes achieve better space utilization when carrying oversize and better weight and space utilization when carrying bulk.
7. The small 156 in. width airplane does particularly poorly in the bulk and oversize role because it can carry only one row of pallets or oversize vehicles but must still be wide enough to carry a tank.
8. Expanding the width of this airplane to the medium size (210 in. width) improves pallet and oversize space and weight utilization considerably. However, the outsize space utilization drops.
9. Expanding further to the larger airplane increases bulk efficiency, keeps oversize efficiency about the same but lowers outsize space utilization even more. (Note that this airplane was designed primarily for carrying pallets.)
10. The optimum airplane to carry all types of cargo lies somewhere between the extremes, possibly close to this medium airplane. The costs associated with building and operating these various airplanes will greatly impact the best solution.

SMALL SIZE AIRCRAFT (AMST)

- ACL - 136,000 lbs.
- Density Ratio - .872
- Pallets - 10

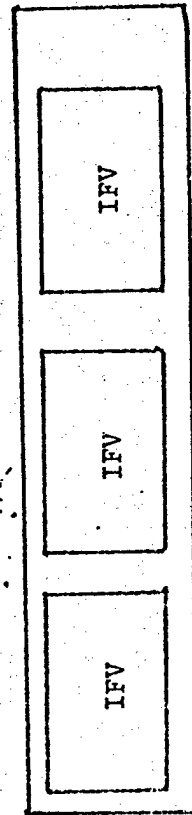
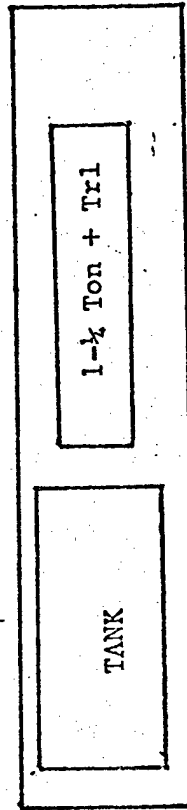
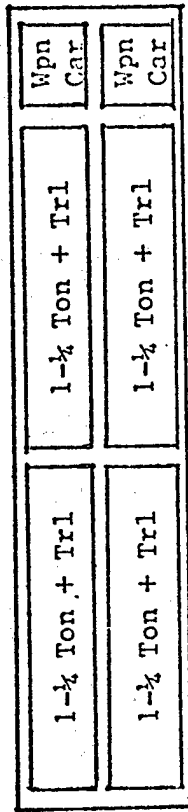
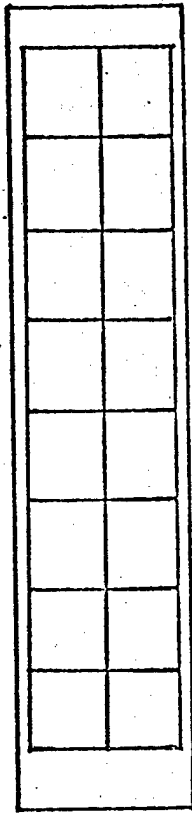
10 PALLETS @ 5000 LBS



MEDIUM SIZE AIRCRAFT

- ACL - 136,000 lbs.
- Pallets - 16 (Sideways)
- Density - .648

16 PALLETS @ 5000 LBS



LARGE SIZE AIRCRAFT (C-5)

- ACL - 240,000 lbs.
- Pallets - 36
- Density Ratio - .607

36 PALLETS @ 5000 LBS

[illegible]

1-½ Ton + Trl	1-½ Ton + Trl	1-½ Ton + Trl	1-½ Ton + Trl	GEN
1-½ Ton + Trl	1-½ Ton + Trl	1-½ Ton + Trl	1-½ Ton + Trl	GEN
1-½ Ton + Trl	1-½ Ton + Trl	1-½ Ton + Trl	1-½ Ton + Trl	GEN

1-1/2 Ton + Trl	IFV	IFV	IFV	IFV
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